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Research Order #1
Phase II Progress Report #1

19 October 1954

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Research Order #1 CONFIDENTIAL
Phase II - Progress Report #1. 19 October 1954

This report covers the period from September 1 to September 30, 1954.

OBJECTIVE:

To design and construct two complete sets of equipment (4 units) to serve as design approval models, based upon the results of the work accomplished in Phase I.

GENERAL DATA:

The work to be performed according to Bid Proposal No. 76-1, Phase II, may, as a result of the work accomplished in Phase I, be summarized as follows:

A. Design of a suitable optical system for transmitting and receiving, to include the following:

1. A light source - thirty watt tungsten lamp as previously described in Final Report of Study Phase I, dated 23 August 1954.

2. A reflector - 8-inch diameter, 6-inch focal length, circle of least confusion, approximately .030" (effective).

3. A suitable condenser lens system, using lens of 1.5-inch aperture and 1.5-inch focal length.

4. A mechanical modulator, as discussed in the Final Report of Study Phase I, for modulating the light from the tungsten lamp and for operating from the transmitter amplifier.

5. A standard "Ektron" lead sulfide cell for receiving modulated light from the transmitter and for furnishing a signal (voice modulated) to the receiver. The cells considered are 1 mm x 1 mm in dimension and have a dark resistance of approximately 400,000-ohms.

B. Design of a suitable electronic system for transmitting and receiving voice intelligence.

C. Design of a suitable power supply for the electronic system.

D. Choice of a suitable power source to furnish power to the entire system.

E. Design of a night viewer to assist in the find operation. This was decided upon as a result of our experience in field-testing a breadboard of the equipment and was confirmed by the opinion of agency personnel. This matter is discussed in more detail later in the report.

F. Design and incorporate a battery charger as an integral part of the equipment. This decision resulted from discussions with agency personnel.

G. Design of a mechanical scan system.

H. Design of a proper carrying case and stable tripod arrangement.

DISCUSSION:

In view of the results obtained from previous work we decided to construct a breadboard system for testing and evaluation both in the laboratory and in the field. The system was constructed using the optical system previously outlined.

A receiver amplifier was constructed having a flat response from 300 to 3000 cycles with approximately 65 db gain. Amplifier noise was approximately two microvolts, referred to the input. A transmitter amplifier was also constructed with a characteristic rise of approximately six db per octave from 300 to 3000 cycles. The maximum power output of the transmitter amplifier available for operating the modulator was approximately 0.6 watt. An oscillator giving a continuous 1500-cycle pure tone output was incorporated in the system for find operations.

Standard Mallory "Vibrapack" power supplies were used for the receiver and amplifier. A 6-volt battery was used for the power source.

Infrared viewers were attached to the optical heads on the breadboards, and the heads in turn were mounted on tripods. No mechanical scan mechanisms were incorporated on the breadboard models.

Several tests were conducted in the country, both during the daytime and at night. Two ranges were used; one range was approximately 1.5 miles, and the other was approximately 4.75 miles.

Good speech intelligibility was obtained at these ranges in both daytime and nighttime operation with weather conditions varying from reasonably clear to rain and exceedingly poor visibility. Two sets of filters were used for visual security in night operation, giving results essentially as good as those obtained without the use of filters. However, the filter problem bears further investigation, and this investigation is being conducted at the present time. It has been agreed between contractor and Agency personnel that a 400-yard visual security is to be attained in the design approval models.

It was found in the course of field testing that landmarks, previously located, were generally useless at night, because they were not visible to the observer. However, the viewer was very effective at night in locating the transmitter.

In daytime operation the viewer was not effective, and it was necessary to establish good landmarks and to know quite accurately the location of the equipment with respect to the landmarks. The pure tone signal from the transmitter proved itself a necessity for the find operation in daytime as well as in nighttime.

In view of the favorable results obtained with our breadboard we proceeded with the work previously outlined under General Data.

The optical system used in the breadboard was not very efficient because the mechanical arrangement of parts was such that they caused obstructions cutting out about 20% of the light from the reflector mirror. Improvements in the optics will be achieved by modifying the mechanical layout of the optical system. This work is progressing satisfactorily at the present time.

As a result of our tests, the electronic system is being redesigned to increase the gain of the receiver amplifier from 65 db to approximately 80 db. Also, it is hoped to further reduce the receiver noise. The transmitter amplifier to be used in the final equipment will have a characteristic rise of approximately 12 db per octave. Whereas in the breadboard, the receiver and transmitter were completely separate and distinct units, certain components of the new system will be common to both the receiver and transmitter, making for greater compactness, less parts, and less weight. Work is being actively pursued on the electronics system at this time.

It is expected that, in view of the good performance of the breadboard system, the further improvements in optical and electronic design will improve still further the system performance and assure an operating range of six miles (average clear weather).

A vibrator, battery-operated power supply has been designed and was mentioned in previous reports. Further work has not been carried out on this unit. Unusual difficulties are not anticipated in completing a satisfactory power supply.

Yardney silver cells have been chosen for the power source, at least, for the first of the design approval models. This decision has been dictated by the fact that our supplier for the 800-cycle generator has not delivered and Maxim Silencer Co., while last reports sound very encouraging on the problem of silencing the engine-generator unit, has not come up with concrete answers. The time factor does not allow us to wait longer so the alternative is, at least for the present, Yardney-silver cells. This decision was confirmed by agency personnel.

Work has not started on the design of the night viewer. However, due to our design experience in this field, we do not anticipate excessive difficulties in solving this particular phase of the problem.

Preliminary consideration has been given to the design and construction of a battery charger to form an integral part of this equipment. No active work has been carried out up to the present time.

An automatic mechanical scan system is being designed at the present time. A considerable amount of this work is completed, and we expect to be able to give a full description of its functioning in the next report.

Only preliminary consideration has been given to the design of the case and the tripod.

PROGRAM FOR NEXT INTERVAL:

1. It is expected that the layout and design of the modified optical system will be completed.

2. Development work on the electronic system will have progressed far enough to determine space requirements and layout in the final system.

3. Work will proceed on the power supplies and battery charger, as well as the night viewer.

4. A considerable effort will be put forth on overall mechanical design problems.

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Report prepared by:

Report approved by:

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